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ABSTRACT

This paper reports on a class assignment written by preservice teachers on the use of mathematics in different professions. The professions included licensed practical nurse, auto mechanic, research and development product manager for industrial cleaning products, dental office assistant, snack bar employee at a beach club, beauty salon owner and operator, apple orchard and fruit stand owner, secretary at a university alumni hall, bus person at a restaurant, video store clerk, professional mover, convenience store assistant manager, pizza restaurant server, meteorologist, and land surveyor. (YDS)

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Mathematics in the Real World: How People in Different Professions Use Mathematics

by
Audrey C. Rule

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Mathematics in the Real World: How People in Different Professions Use Mathematics

Audrey C. Rule, Editor
Associate Professor, State University of New York at Oswego

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Introduction

Origin of the work

Preservice teachers enrolled in several Elementary Mathematics Curriculum and Instruction classes at the State University of New York at Oswego taught by Dr. Audrey Rule participated in class assignments related to the use of mathematics at the workplace in different jobs and professions. Each person either interviewed a family member or close friend about his/her use of mathematics in his/her career, or reported on current or previous personal use of mathematics on the job. During class discussions, preservice teachers expressed how valuable this activity had been in informing them of the usefulness and necessity of mathematics in everyday life situations. Several preservice teachers volunteered to make their work available to a wider audience through the ERIC system so that elementary teachers nationwide would have access to ways that people in various careers use mathematics and would therefore be able to share that knowledge with elementary students. When a young student asks, "When will I ever use this?" his/her teacher will be able to cite several careers that make use of that mathematical skill.

Organization of the work

Dr. Rule, thirteen preservice teachers, and another education faculty member contributed to this work. Highlighted careers are listed in the table of contents. The same mathematical skills (in roughly developmental order) are described for each career. In each case, preservice teachers gave specific examples from the workplace of the use of mathematics.

Suggestions for use of this work

1) This work may be used as a model for similar assignments for preservice teachers in other Elementary Mathematics Curriculum and Instruction classes. After the college students have reviewed the ways mathematics was used in these jobs or professions, they can choose other professions for investigation.
2) Elementary teachers may ask elementary students to read several of the descriptions contained herein and then interview their family members or neighbors as to how they use mathematics in their workplaces.
3) Elementary students engaged in study of a particular area of mathematics, perhaps conversion of units of measurement, may search the fifteen careers described here to make a list of ways this skill is used on the job. They may then want to survey other professionals as they encounter them in everyday life (at a shopping mall, at a healthcare facility, in their neighborhoods) to find out additional uses of this skill.
4) The information contained here is also valuable for helping elementary students learn different tasks and responsibilities of people in different job settings.

Contributing Author: Jen Achilles

Profession Chosen: A Licensed Practical Nurse (LPN) at a college health center (certified in AIDS/HIV testing and counseling)

Mathematics Concept or Content Area	Specific Example from Chosen Profession: **Licensed Practical Nurse at College**
Matching like items	After drawing blood to send for HIV testing, the tube with the blood must be labeled with the name that matches the name on the requisition.
Classification/ Sorting / Listing Attributes	The patients' charts are filed alphabetically and also have the year of graduation on file.
Sequencing/ Numbering Items or Events	To restock medications, first dispose of expired medications. Next, restock the lesser-used medications in the back and the more frequently used ones in the front.
Counting	At the end of the day, statistics (patients) are counted: For example, the number of women and the number of men that were seen that day are tabulated. A typical number of women seen in one day is 20 and a typical number of men seen in one day is 5. Also the number of lab tests are counted for each day.
Using Numbers as Identification Codes	Each bottle of medication has a "lot" number and an expiration date. If given the name of the product, the lot numbers tell from which batch that bottle of medication came. An example of a lot number is NL60097 on a bottle of antibiotics. Also student ID numbers identify the students.
Orientation / Directionality/ Left & Right	Maps are used to give students directions. A map can be drawn to tell a student how to get from the health center to the campus library. Directions: Take a right after exiting the health center and go to the stop sign. Take a left at the stop sign and go down that street a little way and the library is on the left.
Using Numbers for Location	The students' addresses and phone numbers are used to contact students to tell them the HIV lab results are ready. (The actual results are not given over the phone).
Using Drawings to Solve a Problem	Sometimes illustrations are drawn to help a student understand what is going on in certain parts of his/her body. An example: when the student has a fractured wrist, a drawing is made to show the student which bone in the wrist is broken and where the fracture is in the bone.
Using Charts, Tables, or Graphs	When the nurse is counseling students, a graph is made to show them the risks of contracting HIV by different risk factors.

Logic	If a student comes in with a cough and sore throat, the logical action would be to check vital signs, take a throat culture, and prescribe a pain reliever. If the culture is positive, an antibiotic is given.
Addition	A bill is written and the prices are added to total the amount due. An example is if a pain reliever and an ace wrap are given, the medication is $3.00 and the ace wrap is $1.50, totaling $4.50.
Subtraction	If a syringe is overfilled before giving a shot, the amount needed is subtracted from the amount in the syringe to figure out the amount to take out. For example, if 0.5 ccs (cubic centimeters, measures the volume of fluid in the syringe) are needed and the syringe is accidentally filled to 0.7 ccs, then 0.7-0.5=0.2 and 0.2 ccs are taken out of the syringe.
Multiplication	When the doctor orders 3 pills a day for 10 days, the nurse determines the number of pills to give the student by multiplying those numbers. In this example, the nurse would give 30 pills since 3 times 10 is 30.
Division	When ordering supplies, if 48 bottles of a medicine are needed and 12 come in a case (48/12=4) 4 cases should be ordered.
Probability	The more risk factors a student has, the greater the probability of the student contracting an HIV infection. The nurse tells the student he/she has a high probability of having the disease if he/she has many risk factors.
Estimation	Each day, the name of every student that comes into the health center and the health issue for which they were seen for are logged into a book. By the end of the week, the nurse can estimate how many students to expect per day with that problem the next week. For example, during flu season, the number of flu cases per day is estimated, about 3 per day on average.
Percent/ Ratio/ Proportion/ Fractions	When doing physicals, calipers are used to perform the BMI (body mass index) and that tells you the percent of body fat. The caliper is squeezed around the fat on your arm and calf. An example of a measurement is 25% body fat.
Money / Decimals	Most medications given by injection are measured in decimals. For example, 0.5 ccs is a measure of the volume of an allergy serum.
Linear Distance Measurement	For the new HIV testing office that was built, the length and width of the floor were measured to find out how much carpeting was needed. The floor is 15x15 feet, requiring 25 square yards.
Area Measurement	When a new office was built, the measurements were taken to find out how much space was available for the office furniture. The room is 8x15 so only the right sized-furniture and correct amount of furniture would fit.

Weight Measurement	When the nurse is administering sports physicals, the weight of the student is measured. A typical weight is 180 pounds for a 6-foot male.
Time Measurement	Time sheets are used to calculate the amount of hours worked in a 2-week period. A normal amount of hours for a part-time nurse is 40 hours every 2 weeks.
Conversion of Units	When the nurse receives a physical report form from a student's doctor from another country, she converts metric measurements to English measurements. For example if the students weight is in kilograms, that has to be converted to pounds. An example is if the student weighs 72 kilos, he/she weighs 158 pounds. The conversion equation is 1 lb=2.2 kilos.
Geometry/ Angles	When giving injections, angles are used. For intramuscular (in muscle), a 90 degree angle is used. For subcutaneous (beneath skin) a 45 degree angle is used and for intradermal (in skin) a 15 degree angle is used.
Quadrants	To figure out where to inject a shot in the rear without injury to a nerve, one buttock is divided into 4 quadrants and the injection is given in to upper right quadrant.

Contributing Author: Krista Alsworth

Profession Chosen: Automobile Mechanic

I chose the perspective of my Auto Mechanic. I observe the mechanics using Math skills in almost everything that they do with my vehicle while I am there, from the most obvious of converting metric to inches to the knowledge needed to know which vehicle should be put on which lift according to their weights. Many, many math skills are needed in this profession not only for the safety of the mechanics but also for the optimal care with their customers' vehicles. If a mechanic cannot convert from gallons to quarts when dealing with the bulk oil tank, a vehicle may leave the garage with too much or too little oil after an oil change. This business is not only involved with automobile maintenance but is also a state Inspection garage, which also incorporates math skills.

Mathematics Concept or Content Area	Specific Example from Chosen Profession: **Automobile Mechanic**
Matching like items	Auto mechanics match like items every time that they dismantle a vehicle and have to reassemble it. They have to be aware of the sizes of the parts that are being removed from the vehicle and match them to the correct size when putting the new part back on. This is important because different cars need parts that come in many different sizes. Matching like items also occurs when stacking different stocked items, such as tires, according to their sizes. The larger tires would be stacked on the bottom, medium in the middle and smaller ones on top, aligning their centers so that the stack will not topple over. The same idea can be seen when arranging inventory, such as oil filters, on shelves. Filters of the same size are stacked on top of each other because their cross-sections are the same.
Creating/ Continuing a Pattern/ Symmetry	Creating and continuing a pattern occurs when pallets of supplies, such as window washing fluid bottles, are stacked on top of each other in a crisscross pattern for even weight distribution. There are approximately sixteen cases per pallet and the cross-sections of these cases must be alternated or they will crush those that are on the bottom. Consideration must also be given when putting items into their storage cabinets. In order to maximize the space inside the cabinet, the boxes of muffler clamps, spark plugs, etc. are arranged in a pattern so that a certain number of boxes will fit inside each section of the cabinet.

Classification/ Sorting / Listing Attributes

Classification, sorting, and listing attributes occur in the garage while storing parts that have many sizes of one type of item. Examples include the small bulb assortment, belts and garage tools. Things that are needed in a hurry are classified and sorted according to sizes so that they are easily found. The parts and tools are labeled so that the sorting is done in numerical order according to sizes. When the mechanics need to look up a part for a vehicle, the parts are classified within a computer program into different areas based on the type of item being sought.

Sequencing/ Numbering Items or Events

The garage uses a computer program that tells the assembly and disassembly procedures for every type of vehicle. Mechanics can find out the sequence in which they should begin repair on any vehicle. Another area where numbering events may be used within the business is scheduling, not only of repairs but also the mechanics' work schedules and break times. Issuing inspection stickers would also be a numbered event. Inspections are conducted once a year and are carefully monitored because the numbering of the sticker is very important to tracking the vehicle and its registration. Sequencing events also occurs when a recommended service is entered into the computer. After an initial visit, the appropriate months and mileage are planned for the next recommended service on the vehicle. For instance, an oil change would be 3 months or 3000 miles. Those numbers would be added to the customer's record and associated with that event so that it will appear automatically when the due date arises.

Counting

Counting is done every time there is a stock order, which is once very two weeks. Stock needs to be counted, or inventoried, to see how many of one item needs to be ordered and then after the stock arrives, it too, must be counted to be sure the shipment is correct. At the end of the year, all inventory items must be counted to determine a dollar figure for on-hand items. Counting also occurs when giving customers change.

Using Numbers as Identification Codes

Everything that is ordered for the shop has a Purchase Order (PO) number. This number is specific to the part that is being ordered. Identification is also used on individual customer's bills. These are called Invoices and each customer has an invoice number to which that day's bill belongs. A Tax ID number classifies the business itself. Social Security numbers identify the employees. Inspection stickers have an identification code number that follows in a sequential numeric order.

Orientation / Directionality/ Left & Right	When there is a tow call, the mechanic must get the geographical location of the vehicle that needs to be towed and plan the best way to drive to that vehicle. Sometimes the garage is called by E911 and they have to follow directions given to them by the person on the phone to get to the vehicle needing to be towed.
Using Numbers for Location	The cost of towing vehicles is based on distance driven to and from the tow call. A typical tow is approximately $62.00. This is based on approximately 30 miles for a tow. When following directions to a vehicle, sometimes mile markers are used to track location if the disabled vehicle is on a major highway such as I-81.
Using Drawings to Solve a Problem	The computer program prints out diagrams, not just written directions, for repair procedures. The mechanics need these for wiring schematics, timing marks and firing orders. It is a lot easier for the mechanic to have a diagram or drawing right under the hood with him/her to show the way to solve a problem on a vehicle.
Using Charts, Tables, or Graphs	When towing a vehicle there is a chart inside the tow truck, which has a ratio for wheelbase, weight distance and lift, so that the driver knows if the vehicle can be towed or if it needs a flat bed or dolly. Regarding bookkeeping, a table/ spreadsheet is used to track payments made on a loan. Data is then transferred to a graph to show the percentage of interest paid to date. Charts, graphs and tables help in a many aspects of bookkeeping and business management.
Logic	When beginning repair on a vehicle, the mechanic has a logical plan of what parts need to be removed to access the part that needs to be fixed. The mechanic uses logic to avoid removing parts unnecessary to the actual repair that would waste time.
Addition	Addition is used in many business calculations. Examples include the daily/ weekly/ monthly/ and yearly operative costs of conducting business, the cost for repairs to customers' vehicles, the money necessary for payment of the business bills, and totals for parts that are ordered for stock for the business.
Subtraction	Subtraction is used when balancing the checkbook. It can also be used to apply discounts to customers' invoices for such things as gift certificates or discount cards. Subtraction is also used when a customer pays a part of what is owed each month. In this case, a new statement is printed to show the amount owed minus what was just paid. Subtraction is also used to figure an employee's paycheck after all of the necessary deductions have been removed. For example, if an employee's gross wage for the week is $350.00, after taking out taxes for Federal, State, Medicare and Social Security, the employee may only bring home $335. When figuring a stock order, the number on-hand is subtracted from the preferred number to get the desired number of items to order.

Multiplication	Multiplication is used to calculate finance charges on overdue bills. Multiplication is also used to determine the rates and charges on invoices. For example, if a vehicle has 1.5 hours labor at a rate of $42.00 per hour, then those two numbers will need to be multiplied to determine the charge amount. Similarly, when one vehicle needs more than one of the same parts such as spark plugs, the amount needed is multiplied by the cost per one unit and the final charge is derived.
Division	Division is used when converting from fractions to decimals. When working on a vehicle, the mechanic must be able to determine that a 5/8-inch bolt equals 0.625 inches.
Probability	When a customer makes an appointment for car repair, probability is used to report likely time that service will be complete.
Estimation	Estimation is used when a mechanic inspects a vehicle and quotes the cost of the repair. A computer program is used to determine prices of parts and labor rates. Using this program a fairly accurate estimate may be given that includes the job, time and materials needed. The program determines a final estimated cost, including tax. Estimation is also used to plan ahead for spending. For instance, if it is know that a certain bill will be due on a certain date each month, estimation can help plan the spending for the days in between, assuring there is enough money available for bills on their due dates.
Average (mean, median, mode)	The average weight of a vehicle must be known for the safety of the mechanics when lifting the vehicle on the rotary lifts. There are three bays at this garage; on lift is for a car of 7,000 lbs., the second is for 9,000 lbs., and the third is for 12,000 lbs.
Percent/ Ratio/ Proportion/ Fractions	When the garage manager purchases things in bulk, such as motor oil, the percent ratio is used for figuring the price, which should be charged by the quart for the vehicles. Percents are also used by the parent company when they figure the total amount spent each month by the garage and figure any rebates that they give back to the garage.
Money / Decimals	Money and decimals are used all day long at this business. Money is transferred between customer and owner several times throughout the day. Money is also transferred between the business and its vendors on a daily basis. Decimals are used when converting from fractions to decimals in selecting tools.

Linear Distance Measurement	Organization of parts is key to completing jobs in the most proficient way. The garage is measured and plans are made for maximum use of the space. Things that are used the most are stored closest to the mechanics so they can minimize the distances that they move to get to the tool or part that they need.
Area Measurement	While the garage was still in the planning stage, area measurements were determined to efficiently organize each bay and determine its area. A mechanic needs room to maneuver around the vehicles and also to wheel materials around such as the collection tank for doing oil changes and tires when rotating or changing them. The average size of one bay is 20x20 feet.
Volume Measurement	Volume measurements are taken on a weekly or bi-weekly basis to figure out how much oil is in the bulk usable tanks and also in the waste oil tanks. The typical volume of oil in the bulk useable tank at one time is 250 gallons.
Weight Measurement	Lighter vehicles go on the lighter lifts. Considering weight is important so that no one gets hurt not only for lifting vehicles but also when the mechanic has to lift parts up to the vehicle. There are special tools to help the mechanic when lifting and placing heavy parts. A light vehicle such as a car may weigh 1800-2300 lbs. A mid-size car or small truck weighs 4000-5000 lbs. A larger truck weighs between 6000 and 9000 lbs.
Time Measurement	Schedules are made to record customers' appointments and weekly work schedules for the mechanics. Time measurement is applied when determining the jobs being done and how long each will take. If the time needed is more than the time available in the work day, appointments will be moved to the next work day and appointments will continue from there. Elapsed time must also be calculated for customer invoices. If a job takes 15 minutes then 0.25 must be entered into the schedule under the time allotment. Time measurement is used when planning vacations. If one mechanic is planning to be absent for the day or the week, adjustments must be made to be sure that the work can be covered by whomever is working.
Conversion of Units	When a mechanic has an air conditioner to fix, conversions must be made to determine the Freon that will be used. For example, Freon is packaged in ounces, but is added to the vehicle as pounds. So a conversion must be made to know how much to add. There are 16 ounces in one pound. Mechanics also need to know conversions for gallons to quarts to measure other liquids that must go into the car such as motor oil, brake fluid, antifreeze or windshield washing fluid. If the garage buys anything in bulk, it will eventually need to be converted so the correct amounts are added to the vehicles.

Geometry/ Angles	Calculating the amount of storage space under the stairwells or overhead the garage requires the use of angle measurements. This is usable space that the garage utilizes for storing stock and equipment. Also, the computerized alignment machine has tabs attached to the wheels, which must be aligned with the computer. The computer then tells the mechanic how many degrees to move each tab to align the wheel accordingly. Typically a wheel will not need to be moved more than one degree, but could be up to three degrees. The machine also gives readings to let the mechanic know if it is a negative or positive degree to be rotated.

Contributing Authors: Marcia Burrell-Ihlow and Clive O. Burrell

Profession Chosen: R&D Product Development Manager for Industrial Cleaning Products (Researching chemicals that will clean and maintain different industrial floor surfaces.)

Mathematics Concept or Content Area	Specific Example from Chosen Profession: R&D product development manager
Matching like items	The manager matches technical skills necessary to develop a new product line with technical abilities of persons on the manager's team.
Classification/ Sorting / Listing Attributes	Products are classified as cleaners, waxes, and repellants. Each product line has to be assigned to members of the team based on experience, interest, and due dates. The development manager is responsible for sorting and classifying the variety of tasks.
Sequencing/ Numbering Items or Events	Here is a typical sequence of events: 1. A company wanting a new floor- or surface-care product contacts the sales representative of the chemical company. 2. The representative visits the company and gathers information on the needs of the customer, including photographs, budget, and environmental constraints. (For example, a hospital cannot use certain chemicals because patients should not be exposed to them; if the building has poor ventilation, certain chemicals cannot be used; a company that uses other chemicals in its manufacturing process may exclude certain chemicals that react with these chemicals.) 3. The chemical company decides if it will be able produce a product to meet the needs of the customer. If so, then the Research and Development Manager begins his/her work. 4. The R & D Manager selects a team for product development. 5. The team contacts the client for more information. 6. The team begins working on the product. 7. The team creates a product and tests it. 8. The client negotiates a price for the new product with the chemical company.
Counting	The manager counts the number of hours team members have spent working on a new floor-cleaning product. On a typical project, the team spends a total of 72 hours and tests formulations. The research and development manager has to keep track of how long certain jobs take, because if the job takes too long, then the client may not be able to afford the product.

Using Numbers as Identification Codes	Each project has its own numbered account code. Everything that the team works on has a cost that is billed to the client who wants the new product. Typical services include: Travel costs for visiting the client, costs of testing different formulations on the floor or industrial surfaces. There are also codes for the chemicals used in the research and development grant. Instead of saying that they are using hydrogen. They write a code number down. The code numbers are used when putting formulations together. The workers on the plant floor only know what codes they need for the formulations, but may not need to know what the actual chemicals are. This is done for safety, but also so that there are no errors with chemicals that could have very similar names.
Orientation / Directionality/ Left & Right	Directionality is used in the plant for placing products, like chemicals, on the shelves. A particular stock number tells the stock person where to place the product, how to position the product, and how long the product can remain on the shelf. For example, if the number on the product is even, then it is placed on its side in section A. If the number on the product is odd, then it is placed in a dry place facing up in section B. The number on the container tells the stock person in which position and where in the plant to place the product.
Using Numbers for Location	The chemicals used in the formulations are coded, but the location for where the chemical is stored in the plant is also coded. For example, when someone on the floor needs to use a particular chemical, he or she goes to the computer and types in the code being sought. The computer tells the worker where to find the chemical in the building based on a code number. The coding system allows every chemical to be located as it is stored within the building.
Using Drawings to Solve a Problem	Drawings are used in database design, workflow design and for timelines. These drawings are mostly used to demonstrate processes that occur when the product is in the clients' hands. The pictures provide another way of looking at the data. A scaled drawing of the industrial setting would be created in order to visualize the types of obstacles involved in applying the chemical formulations, and the types of applications that might create problems in a setting similar to the real life patterns in terms of wear and tear.

Using Charts, Tables, or Graphs	Graphs are often used to present data to the internal customer (marketing & sales). A chart may be used to track how quickly a particular formulation for a floor wax dries compared to another formulation. A particular time will be selected, and then the chemical will be applied, and then the rate at which each chemical dries will be placed on the computer in order to present the data at a marketing and/or sales meeting. The chart is used to demonstrate the data.
Logic	Problem solving techniques are always required to make sure the project runs smoothly and on time. If you know that the client's industrial workplace must be a very dust-free environment, then the cleaning product must not produce a dusty residue. If the hospital setting needs to have floor cleaners dry quickly, then the formulation needs to dry quickly in order to meet the customers' specifications.
Addition	All Formulation must add up to 100%. Formulation components must be added to the formulation in proper sequence. For example, one product for cleaning floors is 40% ammonia, 10% fragrance and 50% water.
Subtraction	Sometimes the chemical formulation is improved by subtracting weight portions of a chemical component. If there is too much ammonia, then, a certain amount ammonia measured by weight is subtracted and more water is added instead. Subtraction and addition go together.
Multiplication	Multiplication is used in scaling up batches from 300 grams to 8600 pounds. If you know the formulations for creating a window cleaner are 8 parts water, 2 parts ammonia, 1 part fragrance and 1 part coloring, then when the batch is increased multiplication is used to increase the amounts of the ingredients for the larger batch of window cleaner.
Division	Division is used in determining effective formulations. If the formulations used to create a window cleaner are not working, the research and development office will experiment by dividing the amount of one of the chemicals in half or some other fractional amount. When the division occurs, the team member documents the changes and tests that product in order to determine how many more multiple subtractions will need to take place in order to get the most effective formulation.

Probability	The marketing department, in conjunction with the research and development department, determines the probability that the chemical company can devise a chemical product that will meet the customer's needs. If the probability is high, the company will spend time researching and developing a new product. If the client's specifications are too narrow, then the chemical company will determine that the probability of satisfying the customer is low and refuse to take the client.
Estimation	Many of the techniques in formulating are not just science, but art too. (i.e. estimation with trial and error). Sometimes the calculations done in the lab are improved during the testing phase. During the testing phase, the team might decide to pour in a little more of a particular chemical, but the amount is always measured so that if it improves performance, the process can be duplicated for the next batch.
Percent/ Ratio/ Proportion/ Fractions	These formulations (combinations of raw materials) must add to 100% so that when the formulation is scaled up in production (from half liter to 1000 gallons) the proportions are correct. When developing a new chemical product for cleaning and protecting institutional and industrial surfaces, the chemist balances chemical equations using proportions to create the proper combination of chemicals to do the job.
Money / Decimals	The sales department determines a price per gallon or liter of final product. The price per gallon might be $20.85
Linear Distance Measurement	Team members have offices located in the same part of the building so that they can easily travel to each other's offices to discuss project ideas. This minimizes time spent in traveling around the building.
Area Measurement	Calculations are made to determine how much area a formulation can cover, based on product specific gravity, thickness, and effectiveness. The measurements are taken in a small area, and then the larger area is estimated, based on how the particular chemical covers an area.
Weight Measurement	Knowing the weights of particular chemicals is important especially when shipping to a new location. The cost of shipping liquid or the cost of shipping the chemical in powdered or another form has to be calculated in order to determine the best way to transport the product for the client.
Time Measurement	Many of the chemicals used form a protective film over time. Also, in a hospital where the amount of time for cleaning the floors is very short and drying time must be minimized, creating a formulation with the fastest drying time is imperative. Trials are conducted to test the products in order to create a product that dries in the least amount of time for that setting.

Conversion of Units	When a cleaner for a stainless steel surface is requested, the chemists estimate that 40% ammonia and 60% water will work, then they begin conducting trials to determine the best proportions. Often the units are in metric and need to be converted to English. Sometimes the units are in English and need to be converted to metric.
Geometry/ Angles	The bottles or jugs that contain the product are designed so that the product easily pours from the mouth of the bottle when the bottle is tipped.

Contributing Author: Sandra J. Feocco

Profession Chosen: Dental Office Assistant

Mathematics Concept or Content Area	Specific Example from Chosen Profession: **Dental Office Assistant**
Matching like items	Toothbrushes are stacked in drawers according to toothbrush size. Adult toothbrushes are longer and are stacked in larger drawers long-ways. Children's toothbrushes are shorter and stacked sideways in the drawer to maximize space.
Creating/ Continuing a Pattern/ Symmetry	When restoring a tooth, the dentist takes careful molds of the surrounding teeth to create a new tooth that follows the pattern of the other teeth and bite. A tooth too high or too low will not allow an accurate bite.
Classification/ Sorting / Listing Attributes	Accounts receivable are sorted based on 30 days, 60 days or 90 days late. Messages are then placed on bills according to amount of time overdue.
Sequencing/ Numbering Items or Events	The dentist first evaluates the patient and determines if Novocain is needed. If Novocain is needed, he/she gives the patient an injection and waits for it to numb the patient's mouth. The dentist then drills the tooth with a rough drill bit, finishing with a smooth drill bit. Finally the dentist places the filling material in the tooth.
Counting	Checks paid to the office are counted and compared to the number of checks listed on the deposit slip before the bank deposit. For example: if 36 checks have been collected, then, 36 checks are listed on deposit slip.
Using Numbers as Identification Codes	Each patient is assigned an identification number for the computer bookkeeping program. Each dental treatment has a specific code and is entered into the computer. Example: Joe Patient's number is # 2567, and Joe had a tooth extraction with the code # 03156.
Orientation / Directionality/ Left & Right	When the assistant discusses the orientation of a particular tooth with the dentist, they use the terms upper and lower, left and right.
Using Numbers for Location	Each tooth has an assigned number for easy identification of its location. Example: "Please check # 19, the patient feels sensitivity." The dentist knows to look at a tooth in the lower left jaw. Teeth are numbered starting with the upper right molars and continuing left until all top teeth are numbered, straight down to the bottom left and moving to the right.
Using Drawings to Solve a Problem	Drawings are used to show patients exactly how the dentist will repair a tooth. Drawings are used to show children how to brush properly.

Using Charts, Tables, or Graphs	Each patient has a chart of his/her teeth and any restoration that has been done on each tooth.
Logic	Patients need to decide when they can best afford expensive restoration procedures. The Dental Office needs to then devise a payment contract that is agreeable to both parties.
Addition	Each money producer (hygienist, dentist, dental assistant) adds the total amount of money he/she produced for that day. Example: The dentist saw 11 people for a total of $3,780.00, the hygienist saw 9 people for a total of $950.00, and the dental assistant took x-rays for 13 people for a total of $630.00. Total for the day is $5360.00
Subtraction	When insurance checks arrive, they are subtracted from the correct patient's account leaving the balance that the patient owes. Example: account # 3201 owes the office $145.00, an insurance check arrives for account # 3201 for $90.00. $145.00 - $90.00 gives account # 3201 a balance of $55.00.
Multiplication	The hygienist knows how many toothbrushes he/she has by multiplying the number of toothbrushes in a box and multiplying that by the number of boxes in a case. A box contains 20 toothbrushes and a case contains 15 boxes. 20 x 15 = 300 toothbrushes per case.
Division	Profit sharing is determined by the amount of "excess" money divided among the number of employees based on their amount of hours worked for the year. $25,000 excess is divided by total number of hours worked for employees together. 10 employees hours total 15,150 for the year. $25,000/ 15,150 = $1.65 per hour worked. If a person worked 1950 hrs his/her bonus would be $1.65 x 1950 = $3217.82.
Probability	When making restorations, the model of the patient's teeth is sent to the lab and a date is made for its return. Providing there are no holidays or other days that the lab may be closed, a patient can expect a return date of 7-10 days.
Estimation	The dentist estimates a time of healing of 1½ weeks after crown preparation.
Average (mean, median, mode)	The hygienist can determine how much paste to order by taking the average number of patients seen each day (9) and multiplying it by the average number of workdays in a month (18) = 162 cups of paste needed for each hygienist per month.
Percent/ Ratio/ Proportion/ Fractions	Family members of employees will receive 25% (1/4) off all dental work. Patients who pay their bills on the day of service will receive a 10% discount. Example: $160.00 x .10 = $16. Total day of service would be $160.00 - $16.00 = $144.00

Money / Decimals	A bill says the patient owes $159.63. The decimal point tells the dentist that he/she can expect payment of one hundred fifty-nine dollars and sixty-three cents.
Area Measurement	When new carpeting was needed for the office, the length (20 ft.) and width (18ft.) was multiplied for an area of 360 square feet.
Volume Measurement	Each vial of Novocain has incremental markings along the side so the dentist can administer an accurate amount. (.5cc of 1.5 Novocain)
Weight Measurement	Heavy materials such as the plasters needed to make molds need to be placed on the floor since the shelving will not support that much weight. Lighter objects are then placed on the shelves for storage.
Time Measurement	When making an impression of a patient's mouth, it is very important to hold the impression material firmly against the patient's teeth until the loose material has become firm enough to hold the impression. (Approximately 3-5 minutes)
Geometry/ Angles	When performing a root canal, the dentist has to determine the angle of the roots of the patient's tooth. When performing extractions, the dentist needs to find the most effective angle to place his/her instrument to pry the tooth loose. The dentist finds an angle between 35 and 45 degrees best for loosening a tooth.

Contributing Author: Danielle Giorgi

Profession Chosen: Snack Bar Employee at a Beach Club

Mathematics Concept or Content Area	Specific Example from Chosen Profession: **Snack Bar Employee at a Beach Club**
Matching like items	All of the paper goods for the Snack Bar are stacked on separate shelves. For example, all the cups are on the first shelf, the plates on the second and the napkins are on the third.
Creating/ Continuing a Pattern/ Symmetry	The Soft Ice Cream Machine always has Vanilla and Chocolate. On Mondays, the third flavor is Strawberry. Tuesdays it is Coffee, and Wednesdays, it is a Low-Fat flavor.
Classification/ Sorting / Listing Attributes	Foods that must be stored in refrigerated areas are sorted by type. So, fruits and vegetables are in the first walk-in cooler, liquids are in the second and meat and fish are in the third freezer.
Sequencing/ Numbering Items or Events	When there are several orders taken the same time, the orders are numbered as they are placed so the cook, employee and guest all know which tray is which.
Counting	When there is a large order of drinks, the employee counts the number of drinks so he/she can get the correct number of cups.
Using Numbers as Identification Codes	Each family that belongs to the club has a membership number. Instead of paying immediately for food, family members can sign their names and number to have their food is charged to them. It is the employees' job to make sure the members know and sign their numbers.
Orientation / Directionality/ Left & Right	When a new employee is just learning his/her way around the Snack Bar, a more-experienced employee will give directions as to where things are. For example, a senior employee may say, "Extra small plates are to the left of the large plates and directly under the small cups."
Using Numbers for Location	When retrieving extra supplies from the back closet, an employee may tell another that the broccoli is on the third shelf of the first walk-in refrigerator.
Using Drawings to Solve a Problem	There are often many non-English speakers working in the food business. There are signs posted in the back of the Snack Bar and kitchen with diagrams. For example, there is a choking poster and one that explains how to use the meat shredder.
Using Charts, Tables, or Graphs	Every time an employee takes supplies from the backup closet, he/she must note it on the chart. For example, if he/she takes two sleeves of small cups, he/she must go to the cup chart and put two tallies in the small cups row.

Logic	When an employee is preparing for the day, he/she needs to use logic in choosing the supplies needed. For example, if it were supposed to rain all day, he/she wouldn't take out many supplies because it is not going to be very busy.
Addition	If an employee is working at the grill, he/she will need quick addition facts for certain foods. For example, if there are two small orders of wings (3 wings in each order, 3+3) he/she knows to take out 6 wings.
Subtraction	When estimating pay for the week, a Snack Bar employee has to be able to subtract time for lunches. So if he/she worked 5 days, 5 hours must be taken out for each one-hour lunch.
Multiplication	Multiplication is important when placing a food order. If there are 200 shrimp in a bag and an employee orders 5 bags, he/she needs to know how many shrimp he/she will receive.
Division	When an employee is putting away an order, he/she has to divide the food equally between the Snack Bar, the freezer and the outside Snack Bar.
Probability	An employee must consider the probability of holiday weekends being a lot busier than weekdays.
Estimation	When stocking in the morning, an employee must estimate how many cups and plates to take out depending on how the weather is supposed to be.
Average (mean, median, mode)	When preparing for the day, an employee knows that on an average, 15 loaves of bread are used each day. So, he/she makes sure to take out about that many in the morning.
Percent/ Ratio/ Proportion/ Fractions	Snack Bar employees must understand child and adult proportions when making deserts. A child's ice cream cone is half as large as an adult's serving.
Money / Decimals	At the end of the month, the snack bar employee has to go through the orders and determine how much money each family owes for the amount of food family members ordered that month.
Linear Distance Measurement	When an amount of a certain product is low, the employee has to consider the linear distance of the company so they can order more. For example, the snack bar orders special cups from a company that is based out of California. Therefore, the employee has to note immediately when they are becoming low on the cups so they can be ordered in time from that distance.
Area Measurement	When the employee is working on the grill, he/she must carefully space food being cooked so that as many items as possible fit in the limited area of the grill.

Volume Measurement	It is essential that an employee know the difference between cups, liters, gallons etc. when making the club's special iced tea/lemonade drink
Weight Measurement	When working at the salad bar, the employee has to weigh the customers' salads on a scale and then determine the price. Each once of salad costs $0.11 so if a customer gets 5 ounces of salad, the employee must note that the cost of that particular salad is $0.55.
Time Measurement	It is important to keep track of time when cooking food. The employee wants to make sure that he/she doesn't over or under cook a customer's order.

Contributing Author: Denise Graves

Profession Chosen: Beauty Salon Owner and Operator

Mathematics Concept or Content Area	Specific Example from Chosen Profession: **Beauty Salon Owner and Operator**
Matching like items	When making a permanent wave hairstyle, the hairdresser either uses the same color perm rods for the entire head or alternates two different colors of perm rods. Different color rods are different sizes.
Creating/ Continuing a Pattern/ Symmetry	When using two different colors of perm rods, the hairdresser makes a pattern by alternating the two different colors of rods. Symmetry is used to make sure the hair is even on both sides of the head.
Classification/ Sorting / Listing Attributes	After the perm is finished, the perm rods have to be put away in the roller tray. The smallest rods go in the top drawer and the next-to-the-smallest go in the next drawer down, etc. until the largest rods are in the bottom drawer. Attributes are listed on the client's record card: the perm rods used, type of perm used, processing time, formula of color used, etc.
Sequencing/ Numbering Items or Events	Hair color comes in two-ounce bottles and is number- and letter-coded. When the salon owner brings the colors home from the beauty supply, he/she puts the colors in order, writes the color number and letter on the top of the bottle, and puts the bottles in order on the proper shelf.
Counting	If a haircut is $8.00, and a customer gives the salon operator a $10.00 bill, the operator has to count back two ones to him/her.
Using Numbers as Identification Codes	The color bottles are all coded with numbers and letters. For example, 12G2, 82N, 203RR, etc. More than one customer with the same name has his/her hair styled at the salon, so telephone numbers are used to distinguish who is who.
Orientation / Directionality/ Left & Right	The salon was moved from a location in town to the owner's home on a side road, further in the country. People need directions to get to the new location. For example, go over the bridge, turn left on County Route 19, take your 2nd right hand turn onto Meirs Road.
Using Numbers for Location	The salon is 1.3 miles down Meirs Road on the left hand side. The house number is 789.
Using Drawings to Solve a Problem	On each poster of the month there is a picture of the hairstyle of the month and a picture that illustrates how to do the haircut, perm, or color technique used to achieve the style. People choose hairstyles from pictures in books. The hairdresser cuts a person's hair to achieve the style in the picture.

Using Charts, Tables, or Graphs	When changing a client's hair to a lighter hair color, the hairstylist looks at a chart that tells how many levels of color to lighten. The number of levels determines the volume of developer used and whether the hair needs to be pre-lightened or not.
Logic	The hairstylist shampoos the hair first, then cuts it, and finally styles it.
Addition	The cost of a haircut is $8.00. If the client wants his/her hair shampooed, it is $2.00 extra, and if he/she wants it styled it is $2.00 more. If a client buys shampoo, that is added to the price of his/her haircut, shampoo, and style for a grand total.
Subtraction	If the total bill is $18.00 and the customer gives the owner a twenty-dollar bill, the owner subtracts 18 from 20 to give the customer back $2.00 for change.
Multiplication	If a family of four comes in and they all get their hair shampooed and cut, the operator multiplies $10.00 by 4 to get their total bill of $40.00.
Division	If the owner rounds the total telephone bill to $600.00 and divides that by 12 months, this results in an average of $50.00 per month on the salon's telephone bill.
Probability	The salon owner attends college full-time. Because the owner is not putting as many hours into working in the salon, he/she encourages all of the regular customers to schedule their appointments ahead. If they wait until they need a haircut to call, the probability of getting an appointment immediately is small.
Estimation	If someone calls and wants a quote of a price for a spiral perm and the hairstylist is not familiar with the hair length or thickness, he/she will have to estimate the cost because the number of bottles of perm solution needed to saturate the hair is unknown. The hair stylist also has to estimate the time it will take to do the perm and schedule out that much time.
Average (mean, median, mode)	The average person gets his/her hair cut every 5-6 weeks. The average haircut takes a ½ hour. The average perm takes 2 hours to complete. The average color change takes 11/2 hours.
Percent/ Ratio/ Proportion/ Fractions	The owner's family members receive a 50% discount on all services. One of the stylists makes 10% commission on all retail that she sells. The owner claims 20% of the heating and electric bill for the salon on income taxes. Most people have ½ inch cut off their hair every six weeks.
Money / Decimals	The price of a haircut is $8.00. A well-known hair spray sells for $7.50. The price of a perm and haircut is $35.00. Waxing costs $4.00.

Linear Distance Measurement	A couple of elderly women clients have difficulty walking. Their husbands drive up to the front steps so they only have to walk four feet to the steps instead of forty feet that they would have to walk if they parked in the driveway.
Area Measurement	When the floor tiles in the salon were laid, the owner had to measure the length and width to find the center of the floor. the owner drew a line down the middle of the floor. The owner started in the center and worked out toward the walls, completing ¼ of the floor at a time. The room is 14 feet wide and 24 feet long. Because each floor tile measured one square foot, 336 tiles were needed.
Volume Measurement	When mixing hair color, it is important to measure the ounces of color and developer exactly. As a general rule of thumb, mix 2 ounces of color to 2 ounces of developer.
Weight Measurement	When supplies are stored on shelves, the heavier gallons of shampoo go on the bottom shelf and the lighter bottles of hair color go near the top.
Time Measurement	Time measurement is a very important part of managing a salon business. Appointments are scheduled and clients expect the stylist to meet their appointments on time. The owner must be careful not to allow too much time for each client, resulting in wasted time, because in the beauty business, time is money. The stylists set a timers to keep track of the processing times for perms and colors. A ½ hour for a hair cut and two hours for a perm or color are the typical times that are scheduled. Perms or colors usually have to process between 20 and 45 minutes so the stylist may cut another client's hair while a perm or color is processing.
Conversion of Units	Not all hair types produce the same size curl when using the same size perm rod. For example, if a person has very straight hair and a pink rod is used, the resulting curl may be like that of a gray rod (the next size bigger). The stylists has to estimate how he/she thinks the hair will take to the perm, then adjust the rods used according to the desired results.
Geometry/ Angles	Most haircuts have angles to them. When hair is layered, angles are put to it also. The owner uses an imaginary clock many times to check to be sure that the angles on both sides of the head are even. For example, if the hair by the ear is cut, the stylist puts the comb on the bottom of the hair and the comb points to 4 o'clock on one side of the head, on the other side of the head the comb should point to 8 o'clock.

Contributing Author: Jodi L. Kelly

Profession Chosen: Apple Orchard and Fruit Stand Owner

Running an Apple Orchard and Fruit Stand that sells, in addition to apples, baked goods, cider, jellies, honey, and maple products.

Mathematics Concept or Content Area	Specific Example from Chosen Profession: **Apple Orchard and Fruit Stand Owner**
Matching like items	Apple sorters must learn to group and bag apples based on their variety (i.e.) Cortland, Macintosh, Red Delicious, etc.
Creating/ Continuing a Pattern/ Symmetry	When bagging apples, all apples should be relatively the same size and shape.
Classification/ Sorting / Listing Attributes	Apples are sorted by size and condition. A large apple with no bruises is called a "first" and is bagged for sale. However, smaller apples that may have bruises are called "seconds" and can be sold for a cheaper price for such uses as baking.
Sequencing/ Numbering Items or Events	An apple grower must plan for apple blossom, petal fall, and harvest. Growers need to determine the best time for treating and fertilizing the apples, when to start pollination, and when apples will be ripe enough for picking. A chart is often helpful with this in that it can tell you an approximation of what week or month these events will be happening.
Counting	An inventory of how many apples sold or gallons of cider jugged is important throughout the apple season so the marketer can determine when more apples will need to be picked/sorted and when cider needs to be pressed.
Using Numbers as Identification Codes	Zip codes are used when shipping apples because the zone to which the apples are being shipped often determines shipping costs.
Orientation / Directionality/ Left & Right	Maps or directions may be put out while advertising the apple orchard to direct customers. Also a brief diagram of the location of different apple varieties is helpful for people who come to pick their own apples.
Using Numbers for Location	Street numbers and mileage from major landmarks are used to help with directions that may be placed in advertisements for the orchard.
Using Drawings to Solve a Problem	Before arranging the store to start the season, diagrams are used to determine where certain products will go and how they will be arranged.

Using Charts, Tables, or Graphs	When shipping apples, a chart is used to determine the price of shipping based on the weight of the boxed apples. A chart is also used to compare the sales of a current year to previous years to determine gains or losses. Labels are used on bags of apples, cider, and anything else that may be sold at the store of an apple orchard. This is not only for legal purposes of labeling anything for sale, but also works towards advertising!
Logic	Before ordering products to be sold in the store (examples: maple products, honey, jellies and jams), a budget must be developed so ordering does not exceed what the business can afford. Determining what items are most likely to sell also uses logic.
Addition	Adding prices of items that are being purchased or adding the amount of money that was earned in a certain day, week, season.
Subtraction	Subtraction is used when determining the amount of change to give back to the customer after he/she pays for purchases.
Multiplication	Multiplication is used when determining the quantities of ingredients when trying to make a great deal of baked goods such as cider donuts and apple pies.
Division	Division is used when dividing the profits and expenses of the business in a joint ownership of the orchard.
Probability	Probability is used when ordering products or shelving apples to determine what will be needed the most by guessing the popularity of certain items or apple varieties.
Estimation	Estimation is used when determining approximately how many bushels of apples can be picked within a certain frame of time to determine the productivity of the apple pickers.
Average (mean, median, mode)	Averages are taken daily, weekly, and seasonally to determine profits or losses.
Percent/ Ratio/ Proportion/ Fractions	Percents are used when determining the amount of profit or loss. Ratios are used when comparing the amount of apple sales between Retail: Wholesale: Pick Your Own.
Money / Decimals	This concept is used when determining pay rates and paychecks for employees. It is also used when looking at records of profits/losses, paying for any items ordered for sale, when dealing with customers and their costs or change.
Area Measurement	Area measurement is used for determining the amount of apple trees per acre. (50 Semi-Dwarf trees/acre). Also, before stocking the store with apples and other products, the owner must figure out how much space is available for stocking.

Volume Measurement	Volume Measurement is used for figuring how many bushels of apples are in each bin (20 bushels = 1 bin). It is also used for determining how many gallons of cider can be made from one bin of apples, (60 gallons/bin).
Weight Measurement	Weight Measurement is used when shipping apples and figuring cost by the weight. It also used for the baked goods, 5 lbs of donut mix will make approximately five dozen donuts.
Time Measurement	Time Measurement is used for knowing when to hire extra help. The store manager needs to determine what the busiest time of the day or season is so that they know when to have extra help on hand.
Conversion of Units	Conversion of units occurs when pressing cider. For example, 40 lbs of apples will produce approximately 3 gallons of cider.
Geometry/ Angles	Geometry is important for setting up the store. The owner must be familiar with the size and shapes of the store so that he/she knows where certain products should be placed. Geometry is also used with baked goods as pies, fudge, brownies, and other baked products can be sold by individual pieces and the baker wants to make sure that the products are cut into equal pieces.

Contributing Author: Angela Luke

Secretary at University Alumni Hall

Mathematics Concept or Content Area	Specific Example from Chosen Profession: **Secretary at University Alumni Hall**
Matching like items	During the day, the secretary matches each donor's request with the correct category of funding.
Creating/ Continuing a Pattern/ Symmetry	Folders are placed in a file in an alphabetical pattern so they can be found later when they are needed.
Classification/ Sorting / Listing Attributes	Outgoing mail is sorted by zip code, starting with the lowest number and continuing until the highest.
Sequencing/ Numbering Items or Events	The staff puts office supplies in the office closet and counts how many of each item is in the closet. First the larger items are put in then the smaller items.
Counting	The number of hours worked by a secretary is counted each week. The secretary usually works 40 hours.
Using Numbers as Identification Codes	There is a code that represents every organization's account on the university campus. The account number for the math club on campus is A1-0098.
Orientation / Directionality/ Left & Right	For reunions on campus, map of all the events that are going to take place is complied. The shady shore picnic is at President Stanley's house. From there you go straight out of the driveway and take a left at the first stop sign you encounter. From there, take your first right and enter the parking lot for King Alumni Hall. From there you will proceed in the building to look at old yearbooks.
Using Numbers for Location	Envelopes are needed for letters. Telling the person on what shelf number the envelopes are located helps the person to find the correct envelope needed to mail the letters.
Using Drawings to Solve a Problem	When planning a dinner, a floor setup is drawn to organize where people will sit. Herb wanted to sit next to Fran and so Allison made a floor plan to accommodate where everyone wanted to sit.
Using Charts, Tables, or Graphs	The committee wanted a chart of all the members for reference. The chart consisted of phone numbers, addresses and names of all the members.

Logic	The office created the best plan to move office furniture from one floor to another floor. The desks were moved first, followed by bookshelves, and then files. This was the best plan because the larger items were moved before the smaller items making sure there was enough space for everything.
Addition	The office uses bottled water jugs for drinking. The office needed to add the amount of water jugs used in one month to figure out how much to order the next month. In an average month the office will use 7 jugs of water.
Subtraction	When making a huge set of copies on the copier, one needs to subtract how many are already done when trying to figure out how many are left to do. For example 3700 copies needed to be made, the copier could only make 500 at a time. Subtract 500 from 3700 to get the remaining number.
Multiplication	In the morning, members of the staff drink a lot of coffee. The secretary needs to multiply how many packets of coffee were made by how many days the coffee was consumed in a week to find out how many packets to order for the year. If 7 packets of coffee were used per day, then that would make 35 packets a week. If you multiply 35 by 52 weeks per year you get how many packets of coffee you need for a year: 1820.
Division	A scholarship is worth $4,000 dollars over 4 years. The person receiving the scholarship divides how much money he/she receives by how many years it spans to figure out the total for each year. In this case it would be 1,000 each year.
Probability	The Telefund callers want to get the most money they can to help out the school. They use probability to determine who is most likely to donate money based on income, past donations, and time of the year.
Estimation	During Reunion weekend events, food must be ordered. An estimate of how much food needs to be ordered is needed so everyone attending gets what he/she requested. An average of 2500 people come so you would need an average of 2500 plates of food.
Average (mean, median, mode)	When the credit card bill for the company comes in, the secretary needs to figure out the average amount spent, average amount each item cost and average amount each person owes. This month the credit card bill was 500 dollars.
Percent/ Ratio/ Proportion/ Fractions	When reunions are planned, the percentage of those who attended is compared to the percentage of people from different class years. Last year 15% of those invited came, this year 20% of those invited came.

Money / Decimals	Many alumni donate money to gift-giving funds. The correct amount needs to be written down so the decimal place needs to be in the correct spot. This year someone donated 10,000 dollars for the library.
Linear Distance Measurement	The person installing the carpets takes the measurements of the walls to make sure the correct amount of carpet is available. The carpet is ordered based on how big the area is. The front room is 20 square feet. So the installer needs that much carpet to cover the floor.
Area Measurement	Holiday presents need to be sent out to all who are major donors to the Oswego Gift Giving Fund. There needs to be a measurement of how much wrapping paper is needed based on what is being sent out. 100 square feet of paper was needed to wrap all the presents.
Weight Measurement	Items being mailed out need to be weighed on a scale to know how much they are going to cost. The mailing of a book written by an alumnus weighed 2 pounds and cost $3.40 to send.
Time Measurement	Meeting schedules are tricky. A schedule is needed to manage the amount of time allowed for meetings and for traveling to meetings. The president has a meeting at 4:00 pm in Fulton so must leave around 3:40 to make sure that she arrives on time to the meeting.
Geometry/ Angles	Committee members must consider the slopes of land on which reunion picnics will take place. A lot of the alumnus who come to the reunions are elderly and need flatter land to be able to walk more comfortably.

Contributing Author: Heather Masuicca

Profession Chosen: Bus Person at a Restaurant

Mathematics Concept or Content Area	Specific Example from Chosen Profession: **Bus Person at a Restaurant**
Matching like items	At the 'station', there is a specific place for each item used to set and clear a table. The silverware drawer has four sections: two for forks, one for spoons, and one for knives. Below the drawer is where the bread plates and napkins are kept, and above the silverware drawer is where the water glasses and coffee mugs are kept. On a rack on the side of the 'station' are a damp cloth and a dry cloth for wiping down tables.
Creating/ Continuing a Pattern/ Symmetry	Bread plates and triangularly folded napkins are alternately stacked to maximize space in the wait station and to save time during busy hours.
Classification/ Sorting / Listing Attributes	The 'to go containers' are stacked with the large containers on the bottom, the medium sized containers, and finally the small containers on top.
Sequencing/ Numbering Items or Events	There is a specific way to set a table and carry the settings. First you take the placemat, then the silverware, third the bread plate with a napkin, and finally the water glass. To set the table first set down the placemat and the bread plate with a napkin on the left, and then the water glass on the placemat and finally set up the silverware accordingly. To set the silverware up the two forks are placed on the left of the napkin and the spoon and the knife are on the right.
Counting	Two forks, one spoon, one knife, one water glass, and a bread plate with a napkin are needed for each setting, depending on the number of the people will depend on how many settings are needed.
Using Numbers as Identification Codes	Each table has a specific number. This clarifies to which table a waitress, bus person, or hostess is referring.
Orientation / Directionality/ Left & Right	When the restaurant is busy, the waitresses and bus people move around the restaurant in as much of an orderly fashion as possible, passing people only to the left. The person carrying the heaviest trays gets the right of way. When walking behind people in the kitchen the phrase to say is "behind you" so that people do not whip around fast and possibly bump into you.

Using Numbers for Location	The tables are arranged and numbered in order. For example in the fireplace room, the labeling starts in the left corner with '1 t' and all the way around the room to '9 t'. In the middle of the room the tables are bigger and are labeled '10 t-1' and '10 t-2'.
Using Drawings to Solve a Problem	The restaurant has a picture of how the tables and chairs are to be arranged. There are some exceptions of moving the tables (for example if a big party was to come in and we needed to push the tables together).
Using Charts, Tables, or Graphs	There is a chart taped in the kitchen that has a list of jobs for each night of the week for each bus person to do. Some jobs are every night and some jobs once a week (for example refill the salt and pepper shakers every night but on Mondays dump the shakers and wash them).
Logic	When loading a tray, it would make most sense to put all the heavy items (for example glasses or big dishes) in the center of a tray and place the lighter objects (for example silverware or napkins) on the outer part of the tray.
Addition	For each party that reserves a table, bus people must add the number of place settings per person.
Subtraction	All reserved tables require one cheese shaker. All of the cheese shakers are prepared the night before. Bus people must count the number of reservations and subtract the number of cheese shakers, and they are the ones used that particular night.
Multiplication	Each table seats a maximum of four people. The number of tables multiplied by four people equals the total number of people this particular restaurant can seat in a typical night (there are extra tables in a storage room purposely for big parties).
Division	Each pitcher of water holds 100 ounces of water. The ounces held by the water pitcher is divided by the number of glasses and that determines how much water each glass obtains.
Probability	The customers must make reservations on busy nights like Friday and Saturday. The bus person must estimate on how long a party will be occupying a table so he/she can tell the "walk-ins" how long the wait is. The typical busy part of the night usually is between 6 p.m. and 8:30 p.m.
Estimation	The bus people must estimate how long it will take each person to finish a meal so that the bus person can remove the dinner and wrap it up or just put the plate on the tray.
Average (mean, median, mode)	The average amount a bus person would make in tips on an average weekend night is $20.00 and during the weekdays, $10.00.

Percent/ Ratio/ Proportion/ Fractions	An estimated ten percent of what the server makes in tips is "tipped out" to the bus people. Usually each bus person works for two servers.
Money / Decimals	The menus determine the prices of food and beverages. Gratuity is automatically added to parties over 15 people.
Linear Distance Measurement	The tray stands are placed strategically throughout the dining rooms, one at each end and if space allows a few throughout the middle rows.
Area Measurement	When setting up the restaurant, the bus people must arrange the tables in proportion to each other and the tray stands, before the night begins to organize a room.
Volume Measurement	There are 3 different plastic boxes that hold 3 different colored napkins. The top of the box determines how many napkins are stacked; the width and the length determine how many napkins fit in each row and how many there will be in length (for example there is ten napkins stacked, 5 napkins in length, and 7 napkins in width, making 350 napkins in each box). Again, when the napkins are stacked they are alternated to maximize space. The purpose of this is to keep the napkins organized because different colored napkins go in different rooms.
Weight Measurement	Big plates/heavy dishes are placed in a bus pan. Glasses and silverware are placed on smaller trays.
Time Measurement	When cleaning a table, resetting a table, and removing the dirty dishes from a room, there is a certain order bus people must follow because the people who are waiting for a table need to be seated as quickly as possible. First bus people need to remove the dirty dishes from the table; second wipe the table and chairs down; third reset the table; and fourth remove the tray to the dishwashers.

Contributing Author: Kim Oleyourryk

Profession Chosen: Video Store Clerk

Mathematics Concept or Content Area	Specific Example from Chosen Profession: **Video Store Clerk**
Matching like items	At Video Paradise, the owners determine the subject of each movie and use these subjects to categorize them into sections. Example: A horror film would be categorized under the horror section in the video store.
Creating/ Continuing a Pattern/ Symmetry	In the old release section of the video store there is less space for all of the movie boxes to fit on the shelves. To make up for this lack of space the boxes must be turned at a 45-degree angle.
Classification/ Sorting / Listing Attributes	The movies are classified by age as well as by subject. The new releases have their own section with mixed subjects. When those movies become old enough they are put into their proper category.
Sequencing/ Numbering Items or Events	The movies are assigned a number according to the date they are released. An older movie like "Dirty Dancing" may have a number of 1528 whereas a newer movie could have a number of 5500. This allows the clerk to find the movies faster.
Counting	Counting can be used for many things at Video Paradise. One easy example of counting is counting the money at closing, or counting how many videos were sold at the end of the night.
Using Numbers as Identification Codes	Each movie has its own specific number that allows employees to find it more easily when needed. One popular movie is number 1596, which is titled, "Goonies".
Orientation / Directionality/ Left & Right	When customers ask where to find the new release section of the video store, I reply, "Walk straight ahead and take your first right".
Using Numbers for Location	In the late list box, there are numbers that correspond to how many days late a movie is. If a movie is 2 days late there is a tab inside the box that has the number 2 on it. The information of the people and title of movie is on a card inside that slot.
Using Drawings to Solve a Problem	Certain advertisement cutouts require diagrammatic instruction on how to assemble them. An example could be putting together a cutout person like the "Terminator". Step number one could be to place together the head and the shoulders of the cutout. Step number two could be to slide in both legs of the cutout into the torso. Step number three could be to connect the arms onto the chest, and step four could be to fold out the bottom so the "Terminator" is able to stand up right.

Using Charts, Tables, or Graphs	Video Paradise's late list is handwritten everyday in a chart form. This late list allows us to know the name, phone number, movie and date of when the movies were due back.
Logic	Sometimes when movie cards get mixed up, it takes time to figure out which movie belongs to the right box. This sometimes requires locating the correct number of the movie.
Addition	If a customer brings up a movie and a candy bar, the two items must be added together to give the total. Example: One movie = $2.13+ one candy bar = .50, which equals $2.63
Subtraction	If a customer brings up four movies and the total is summed, then the customer says that he/she has a gift certificate for $5.00 then the $5.00 is subtracted from the total amount. ($2.13*4)=$8.52 ($8.52-$5.00)=$3.52
Multiplication	When a customer has more than one movie at the same price, the amount of tapes is multiplied by the price for one movie. Example: One movie is $2.13 including tax, so 4 movies would be $8.52
Division	At Video Paradise movies are 2 for 1. If a customer gets two movies, then the total amount is actually half the price of what it should be.
Probability	There is a gumball machine at Video Paradise that allows customers the opportunity to win a free movie rental. There is a 10% chance that the gumball will be a winner.
Estimation	Sometimes customers at Video Paradise have outstanding late fees. What usually is done is that amount is rounded to a lower fee even dollar fee to make it easier on the customer.
Average (mean, median, mode)	The average profits determine the amount of movies that can be bought for the following week.
Percent/ Ratio/ Proportion/ Fractions	Normally videos are one-night rentals, but customers can have the movies longer. For each additional day of one movie there is a 50% extra charge on that movie. Example: a movie for one night is $2.13; for two nights it would be $3.13 because $2.13 + $1.00= $3.13. The $1.00 extra is a rounding off of half of the initial price.
Money / Decimals	The decimal point on the register is broken, so to determine the total amount made at the end of the night, the closer must add a decimal point two places from the end of the number (to the left). Example: If the register reads 20000 then the actual amount made would be 200.
Linear Distance Measurement	The movies are organized around the register area so the clerk does not need to move into a separate room to retrieve movies.

Area Measurement	When putting away movies, the clerk needs to determine the area measurement of the shelves to see if the movies can fit onto the shelves without falling off. A movie usually takes up about a 1" * 4" space.
Volume Measurement	When fire codes are given, there is a defined volume of people that can occupy the store at one time. Only about 30 people are able to be in Video Paradise at a time. This is done for safety reasons, so that people could quickly exit the store in an emergency.
Weight Measurement	When packing movies into a bag, weight needs to be taken into consideration because if the amount of weight is too heavy the bag will break. A plastic bag could hold about seven movies. After seven movies there is too much strain placed onto the bag.
Time Measurement	When opening up the store, the clerk must determine the most efficient way to write the late list and finish all of the other opening procedures before 10:00 AM when the store opens. A good procedure could include: 1) Assemble the money in the cash register; 2) Write the late list; 3) Turn on the lights in the front window; 4) Unlock the front door.
Conversion of Units	When trying to figure out how much a customer owes for late fees, the clerk would need to multiply the price of the movie by the number of days late.
Geometry/ Angles	The clerk needs to be aware of the amount of room located on each shelf to help maximize the amount of space on the shelves. To help maximize the space, boxes can be turned 45 degrees on the shelves so more boxes can fit.

Contributing Author: Audrey Rule

Profession Chosen: Professional Moving and Storage

Mathematics Concept or Content Area	Specific Example from Chosen Profession: **Professional Moving & Storage**
Matching like items	Movers stack boxes that are the same in cross-section to fill the van space completely. For example, the medium size boxes are stacked on top of the large boxes because their cross-sections are the same.
Creating/ Continuing a Pattern/ Symmetry	When glasses are packed in a box, they are carefully aligned in the same way to maximize the use of space.
Classification/ Sorting / Listing Attributes	Items are sorted so that heavier items like boxes of books are on the bottom. Fragile items, such as crystal glasses, are carefully packed in paper. Light items, like couch cushions, are put near the ceiling.
Sequencing/ Numbering Items or Events	The moving van driver surveys the items in the household and determines the order in which items will be moved onto the van. Two tiers of boxes will be loaded first, then the mattresses. Later, the couches and chairs from the living room will be loaded.
Counting	The number of each type of box is counted. There were 38 boxes of books.
Using Numbers as Identification Codes	Each box or item is given an inventory number with the Lot Number and Piece Number printed. The Lot Number for the household was C45443. The Piece Number for the television was 253.
Orientation / Directionality/ Left & Right	The moving van driver asks for directions to the new rental house. "Take Highway 104, turn left on 5th Street, then left on Van Buren to 91 Van Buren."
Using Numbers for Location	The cost of the move is partly dependent upon the distance of the move. The moving agent uses a map to determine the regional code for the place to which the household will be moved. A move from Boise, Idaho to Oswego, New York is a distance of 2600 miles.
Using Drawings to Solve a Problem	Moving boxes come with assembly instructions and diagrams printed on one side.
Using Charts, Tables, or Graphs	The moving agent uses a chart that lists weight and distance to determine the cost of the move.
Logic	When taking apart a bed, movers determine which screws must be taken out first.

Addition	The cost of hauling the household in the moving van is added to the cost of packing the household to obtain a total cost for the move.
Subtraction	A moving van is weighed before being loaded and after loading. The difference between these two weights is the weight of the load. The weight of our household items was 14,000 pounds.
Multiplication	The agent can determine the volume of a load of boxes by taking the square footage of each box and multiplying it by the number of boxes.
Division	The total cost of our move was $7,200. Since the household was moved 2,600 miles, the cost per mile was $2.77, which was obtained by dividing the cost by the miles.
Probability	The moving company usually guarantees a delivery date for the moving van. Agents must consider the probability of delays when determining the date. Our guaranteed delivery date was ten days from our load date.
Estimation	The moving company agent visits the home prior to the move to estimate the size of truck needed and the time it will take to load the items on the van. Our agent estimated that we would fill about one third of a huge moving van and that would take 6 hours to load. He also estimated that we had about 12,000 pounds of household items. It turned out that we actually had 14,000 pounds.
Average (mean, median, mode)	The average weight of household items is 6.8 pounds per cubic foot. The moving agent uses this information to estimate the total weight of a stack of boxes by multiplying the cubic feet by 6.8.
Percent/ Ratio/ Proportion/ Fractions	If a customer asks for the household to be professionally packed, a discount will be given when several boxes of the same type are used. Often, 10, 30, or even discounts of 50 percent are given if there is a large amount of packing.
Money / Decimals	The total guaranteed price for our move was $7271.00. A decimal point was used to separate the dollars and cents when the check for payment was written.
Linear Distance Measurement	The driver of the moving van determines the place to park the van so that the distance from the van to the door will be minimized. Movers carrying heavy china cabinets or couches want to move them the least distance possible.
Area Measurement	When setting up the queen-size bed upstairs, the movers made sure that there was sufficient cleared area on the floor for the bed.

Volume Measurement	The inside of a moving van is marked off in increments of hundreds of cubic feet. The items are loaded in tiers separated by canvas curtains and straps. A tier is a solidly packed volume of boxes and items, which extends up to the ceiling and has a flat front surface. The driver uses the markings to determine the number of cubic feet packed so far. The tier system helps keep the load from shifting as the van travels over bumpy roads.
Weight Measurement	Heavy items such as books should be packed in small boxes. Lighter items such as plastic food containers can be packed in larger boxes.
Time Measurement	The moving agent must plan the route for a moving van and which loads will be picked up and dropped off along the way. Timing is important because delivery dates are guaranteed. The van that carried our load from Boise, Idaho to Oswego, NY stopped in Colorado twice to pick up loads. Then it dropped off a load in Ohio and had one waiting in the back of the van for New Hampshire when it unloaded ours.
Conversion of Units	A moving agent has a table that converts typical furniture items into the cubic feet they will occupy in the moving van. For example, a rocking chair takes 12 cubic feet, a triple dresser takes 50 cubic feet, a single bed takes 40 cubic feet, and an overstuffed chair takes 25 cubic feet.
Geometry/ Angles	Movers must consider the slope of a set of steps when setting up ramps for moving items. A long ramp placed over the steps will not be as steep and will be easier to climb when carrying a heavy dresser.

Contributing Author: Sarah Stewart

Profession Chosen: Convenience Store Assistant Manager / Clerk

Mathematics Concept or Content Area	Specific Example from Chosen Profession: **Convenience Store Assistant Manager/Clerk**
Matching like items	Clerks have to match the correct currency in the drawer to the currency already there. For example: they have to put the fives in with the other fives.
Creating/ Continuing a Pattern/ Symmetry	Clerks have to make sure that when they are putting the money in the drawer that they all face the same way in the till.
Classification/ Sorting / Listing Attributes	When a truck comes in with new products, the clerks have to put the correct product in the correct space. The products also have to be in the correct section and that they are facing forward so that the customer can see what it is. For example: A case of bottled drinking water comes off the truck. It is a new product and it goes in the Beverage section.
Sequencing/ Numbering Items or Events	When a clerk comes on for his/her shift he/she must first check the gas and make sure that it is even. He/she needs to do this to make sure that there have not been any gas drive-offs. This have is done in a particular sequence: first make sure that all of the gas pumps are clear; second get the sales number off of the gas console; and third they must get a reading off of the register.
Counting	The clerk has to count the money in the drawer when he/she comes on to a shift and also when he/she leaves a shift. Every drawer starts with $50.00 in ones, fives and tens.
Using Numbers as Identification Codes	When a clerk is doing an order for milk he/she has to look at the inventory number and then look for that number on the inventory sheet and order accordingly.
Orientation / Directionality/ Left & Right	Many times a store clerk has to give directions to some place for a customer. Therefore he/she has to be able to give correct directions using left and right. He/she also has to be aware of what is around the store. For example, if a customer wants directions to the zoo, the clerk would tell him/her that to take a left out of the parking lot, and keep going straight on State Street. When he/she comes to the next traffic light, take a left on to Thompson Street. Go straight on Thompson St. until the first stop sign. At this stop sign, take a left. Then continue up the hill and the zoo is off of that road on the right.

Using Numbers for Location	When a tote comes off of the truck it has a number on it, which tells the clerk that it is for their particular store as well as where it goes. For example: if a tote comes off of the truck and it says: 441/5/22DA. The clerk will know that it is for their store because their store number is 441. They will also know that it is the fifth in a series of 22 and it goes to the dairy section.
Using Drawings to Solve a Problem	When a clerk is given the job of setting up a display he/she must follow a drawing. Most of the time the drawing does not look like what is available in the store so he/she must determine a new way to set it up given what is present at the store.
Using Charts, Tables, or Graphs	When having a contest with another store in the area, the clerk will have to be able to read a graph which shows who is winning the contest so that they know how much more needs to be sold in order to beat the other store.
Logic	When making a schedule for the store, the manager must be able to use logic to cover every shift. The manager has to make sure that there is someone in the store at all times that has a key. In case there is any reason that the store needs to close. For example, if the power goes out, the manager will close the store.
Addition	When a clerk is redeeming instant lottery tickets for a customer they have to add all of the lottery cards together in order to give the customer the correct amount back.
Subtraction	The clerk must use subtraction to give change for a twenty-dollar bill. If a customer gives the clerk a $20.00 bill and their bill comes to $12.44 the clerk has to subtract $12.44 from $20.00 and give the customer $7.56 back.
Multiplication	When putting together a deposit for the bank, a manager must multiply the number of twenties by 20 in order to get the correct amount to put on the deposit slip. For instance if you have 104 twenties you have $2,080 in twenties. (104x20).
Division	The manager must be able to divide the number of customers in an hour by the amount of money received in order to schedule people accordingly. There are typically 35-50 customers per hour.
Probability	When making a bet with another store about which store is going to sell more ice cream in the ice cream sale they have to think about what they will most likely sell.
Estimation	When doing the milk order for a truck the manager has to estimate how many gallons and half gallons the store will sell in a three-day period in order to assure that they are going to have enough milk on hand. On a typical day the store sells about 30 gallons and 45 half gallons of milk. The manager needs to make sure that the store will have enough milk for three days.

Average (mean, median, mode)	The manager has to track the average amount of people a clerk ID's in order to see if that clerk can be scheduled the next week. The store has a twenty percent cutoff. If you ID more than 20% you can work the following week, but if you do not, you cannot be scheduled for seven days.
Percent/ Ratio/ Proportion/ Fractions	When a manger splits up the clerk incentive for a given month they must first establish what percent of the incentive will each clerk get. For example I get twenty percent of the incentive each month. Whereas a regular clerk may only get five or ten percent.
Money / Decimals	A clerk has to deal with money everyday. So he/she must know the basic denominations of American currency. They have to know what the money looks like as well as how much any given bill or coin is worth.
Linear Distance Measurement	When a clerk is sent to another store to get something for the home store, he/she must keep track of the amount of miles it took to drive there and back for travel reimbursement.
Area Measurement	When setting up the store after the floors have been stripped, cleaned, and waxed, the clerk must be able to measure where each set of shelving went before in order for the clerk to put it back to the way that it was.
Volume Measurement	When making coffee for the air pots, a clerk has to know how much coffee will fit into that particular air pot so that nothing is wasted.
Weight Measurement	When making sandwiches for customers, the clerk has to make sure that they put 1/4 of a pound of meat for regular sandwiches and a 1/2 pound for subs.
Time Measurement	The manager has to be aware of how long a person works and make sure that the person gets a break. If a person works four hours he/she is entitled to a ten minute break and if he/she works more than four hours, the clerk gets a half and hour break.
Conversion of Units	When putting dates on sandwiches a clerk must convert from standard twelve-hour time to twenty-four hour time. For example if they make a sandwich at three o'clock in the afternoon they will put 15:00 on the sandwich so that the person that works tomorrow knows that they need to be thrown out at 3 o'clock.
Geometry/ Angles	When setting up the counter clerks must be able to fit everything on the counter in a neat and orderly way. They must fit the coffee hot trays and the food warmers on the counter so that they are eye catching to the customer.

Contributing Author: Christine Storie

Profession Chosen: Pizza Restaurant Server

Mathematics Concept or Content Area	Specific Example from Chosen Profession: **Pizza Restaurant Server**
Matching like items	When a server is clearing a table plates and cups are stacked on the server-tray. This makes more room on the tray to fit the rest of the dishes. That way, servers make as few trips to the kitchen as possible. This is important because quickness is the key to waiting tables effectively.
Creating/ Continuing a Pattern/ Symmetry	When a large party of 6 or more makes a reservation, the restaurant staff likes to be prepared ahead of time. Therefore, the server takes the plates out at once and places them each on the center of the placemat creating a pattern all along the table.
Classification/ Sorting / Listing Attributes	After a dirty table is cleared, the server places the contents on a tray. Once the server gets to the kitchen, he/she puts the napkins and leftover food in the garbage, stacks the plates in the plate pile, places the pans in the pan pile, and sorts the silverware into soaking buckets. If this isn't done properly, the dishwashers become irritated because it makes their job more difficult.
Sequencing/ Numbering Items or Events	Servers feel stressed when the restaurant is busy. Servers must be careful to take care of people in the order that they arrive. Therefore, servers bring soda and breadsticks to their first tables, then the second ones, and so forth.
Counting	If there is a table of 4, the server counts out 4 forks, 4 knives, and 4 plates to bring to the table. If this is not done before the server takes their orders then the server might forget something.
Using Numbers as Identification Codes	Each customer is given a ticket number (even though they usually don't know this). This number is helpful in case changes on the ticket need to be made. It is also helpful in cashing out the bill, to locate it on the computer screen. For example, if a ticket number is 234 and the server loses the actual ticket, he/she can just look it up on the screen and it will tell what the customer ordered.
Orientation / Directionality/ Left & Right	When there is more than one server on tables, servers are given sections. If there are five servers, for example, the sections are front E, back E, front A, back A and fireplace. It is important that servers know the sections so that everyone gets a turn at taking a table.
Using Numbers for Location	Each table in the restaurant is given a number according to its row. It's important to know this number because if another server seats customers at a table in row 51, the server assigned to the table must be able to locate and serve them quickly.

Using Drawings to Solve a Problem	The new servers were confused about the table numbers so a map of the tables in the restaurant was drawn and labeled with the correct numbers and color-coded sections.
Using Charts, Tables, or Graphs	Servers should keep a chart of how much money made in tips per week. Therefore, when a server arrives at home, he/she records the day of the week, the shift, and the amount of money made in tips. This is a good idea so that servers have evidence at the end of the year when claiming tips for taxes. For example, in the last three days the author made $35.00 Sunday working 5-9; $22.00 on Monday working 4-7; and $28.00 on Tuesday working 5-8.
Logic	When the restaurant is busy, servers have to decide what to do first: wait on customers that the server already has, or seat people waiting for the table. To try to make everyone happy, serve people as soon as possible. Servers usually choose to wait on my tables first, because they are the main factor affecting the tip.
Addition	When customers use more than one coupon, servers have to add them together before taking the total price off the bill. For example, if there were an older person who qualified for the senior discount who had a coupon for a free personal pan pizza, I would have to take their $2.00 off for senior discount and add that to the price of the personal pan. 2+1.99=$3.99 total price off the bill.
Subtraction	If a customer is not happy with his/her pizza, then servers subtract $3.00 off a large, $2.00 off a medium, and $1.00 off a small pizza to compensate the customer.
Multiplication	If there were a table 10 and they each ordered a 5-piece order of breadsticks, multiplication (10 people x 5 breadsticks = 50 breadsticks) is used top determine to put 50 breadsticks in the breadstick oven.
Division	If there is a bus girl helping us clear tables on a busy Friday night, then servers give her 7% of our tips. The equation used is 7/100 = how much I giver her/ total of tips I made. For example, if a server made $120.00, he/she would give her 7%, which would be $8.40. Without division servers could not do this calculation.
Probability	The sections for servers are decided on a first come, first serve basis, since some sections have more tables than others. The probability that the other servers will get there 20 minutes early is pretty good. Therefore, the author comes in 30 minutes early to always get the best section. Hey, the early bird gets the worm, right?

Estimation	If the author sees that there is a big table of 9, then the author assumes that there will at least be one order of breadsticks. The server throws them in the oven before even going to the table. If they are not needed, the next server can use them, but if the people at the table do need them the server will be prepared and the table will get faster service.
Average (mean, median, mode)	The average customer tips about $1.50 per adult. If there are 10 people, the server should expect a $15.00 tip.
Percent/ Ratio/ Proportion/ Fractions	Senior citizens get a 20% discount. If a senior's bill comes to $20.00 then he/she will get $2.00 off and the bill will be $18.00.
Money / Decimals	A customer is given a bill with the amount that he/she owes in decimals form: for example, $18.25.
Linear Distance Measurement	When choosing a section, the author likes to choose front E, not only because it has more tables, but because it is closer to the kitchen, making it easier to carry out the food, and to carry the dishes back in.
Area Measurement	If a large party of 25 comes in, then the employees put together enough tables for the party to have one person per chair, and move the rest of the tables away so that the server has room to get to the table. This is why it's important to make reservations so that this can be done ahead of time.
Volume Measurement	Customers often wonder if they should order individual sodas with free refills or pitchers of sodas that don't have free refills. The regular soda is about 12 oz., and the pitchers hold about 50 oz., which are about 4 ½ cups of soda. So if there are four people and they don't need refills, the cheaper way to go would be pitchers.
Weight Measurement	One time the author had to take a delivery since the drivers were busier than the servers. the author made sure that the large pizza went on the bottom, then the small pizza, and then the order of breadsticks. This is not only good so that the large pizza didn't crush the breadsticks, but it was easier to carry.
Time Measurement	When the author took that delivery the author was under a little pressure because deliveries are guaranteed in less than 30 minutes or the customer can get a discount. It takes pizza about 12 minutes to go through the oven, so the delivery person had the remaining time to get the pizza into the car, and find the correct house. Because there was only one delivery it was not a problem, but having more than one would have been a little bit more stressful.
Conversion of Units	Customers sometimes don't understand the exact size of a "large", "medium", or "small" pizza so servers convert the size words to inches so that they better understand pizza sizes.

Geometry/ Angles	When the restaurant is not very crowded, employees place the tables at an angle so that the restaurant looks nice. On the weekends when it starts to get busy and servers have to accommodate large tables, servers move the tables so that they are going straight up and down the rows. This creates more room for the tables themselves, and more room for the servers to get through.

Contributing Author: Kelly Wirth

Profession Chosen: Meteorologist

Mathematics Concept or Content Area	Specific Example from Chosen Profession: Meteorologist
Matching like items	Meteorologists can compare past storms to present weather to predict the effects, for example in the past a 280° wind across the lake has produced lake effect snow. Meteorologists can measure the wind to predict the chance of lake effect.
Continuing a Pattern	A meteorologist can look at patterns such as El Nino and La Nina to determine temperature and precipitation trends. Certain weather patterns can be recognized to predict the weekly forecast.
Sorting	Compilation of surface data to seek out current weather conditions around the state is needed before forecasting. For example, if it is raining in Rochester and Syracuse, there is a chance that it may rain in Oswego.
Sequencing	Forecasting must be followed in a specific sequence: 1) seeking current weather conditions; 2) observing computer models; and then 3) forecasting the weather.
Counting	Meteorologists must look at computer models for liquid amounts of precipitation and count total amounts for any given area. For example, they must be able to count the total number of inches of rainfall. Oswego meteorologists must count each month's total precipitation to arrive at the total amount of precipitation for the year, a total of 41.4 inches in 2001.
Using Numbers as Identification Codes	Meteorologists use number codes for various pieces of data. For example, broken clouds at 600 feet are coded as "Bkn 06" and scattered clouds as 6000 feet are coded as "Sct 60".
Directionality	Meteorologists must read maps to forecast for an area and utilize north, south, east, and west to forecast wind direction.
Using Numbers for Location	Meteorologists must use latitude and longitude to plot hurricanes and directions of an air mass. Using numbers for plotting weather enables meteorologists to determine speed and direction of storm systems.
Using Drawings to Solve a Problem	Meteorologists in this area draw Lake Ontario and sketch the setup of lake effect bands to predict where the band will hit.
Using Charts, Tables, or Graphs	Meteorologists use bar graphs and line graphs to illustrate precipitation amounts for hourly rainfall. Meteorologists on TV also use graphs to better illustrate a comparison.

Logic	National Weather Service meteorologists must plan when to alert the public of dangerous weather; their number one goal is "protect life and property".
Addition	Snowfall amounts are added over the course of winter months; rainfall amounts are added over the course of summer months. For example, the 2001 summer season in Oswego brought 3.40 inches in June, 2.60 inches in July and 3.40 inches in August. To total summer rainfall amounts, meteorologists must add 3.4+2.6+3.4 to arrive at 9.4 inches of rainfall.
Subtraction	The difference in snowfall amounts is tracked from year to year. Meteorologists find the difference between this year's snowfall and last year's snowfall by subtracting the two values. Meteorologists might subtract last year's total snowfall of 88.7 inches from this year's snowfall of 90.4 inches, and arrive at an equation such as 90.4 – 88.7= X
Multiplication	The snowfall total can be found by multiplying the snowfall rate (ex. 2 inches per hour) by the duration (4 hours).
Division	Hourly snowfall rates can be found by dividing the duration (i.e. 12 hours) into the total amount (18 inches).
Probability	Meteorologists use probability when forecasting the chances of precipitation. For example, there may be an 80% chance of rain, or an 8/10 chance of rain, affecting the forecast area.
Estimation	Meteorologists estimate snowfall through studying computer models. For example, they know that generally 1 inch of rain = 10 inches of snow. If the computer model predicts ". 4 inches" of precipitation, they estimate that 4 inches of snow will fall.
Average	To find average temperature of any given day, meteorologists add the high temperatures of that date over a 30-year span, and divide by 30 to find the average high temperature.
Proportion	Moisture flux off a lake is proportional to the wind squared. The greater the wind, the greater the amount of moisture that is picked up off the lake.
Money	Local meteorologists sell specialized forecasts to area ski resorts and the Department of Transportation. A Central New York meteorologist may bill an area resort $900 yearly for specialized forecasts.
Linear Distance Measurement	The distance of an air mass in the atmosphere is measured in millibars (MB), a unit of pressure. The distance between the 1000 MB and 500 MB is often referred to as the thickness, which is measured in decameters (DM). The greater the value or thickness, the warmer the mean temperature. For instance a common thickness in the summertime is 588 DM while during the winter a 540 DM thickness is more likely.

Area Measurement	The area of rainfall is measured on a computer to predict if rain will hit the forecasted area. For example, the area of rainfall on an Oswego meteorologist's computer is measured as 2 inches by 2 inches. The area of Oswego and the path of the rainfall need to be taken into account to predict the chance of rainfall.
Volume Measurement	Meteorologists must measure the volume of helium put in a weather balloon. These balloons are launched twice a day everyday at many weather stations to measure temperature at different heights in the atmosphere.
Weight Measurement	To obtain snow to water ratio, the liquid equivalent of snow is found based on its weight.
Time Measurement	Storm movement is found using time measurement by marking the start time of precipitation. For example, if a line of storms has moved from Buffalo to Rochester in an hour and is currently over Rochester, Oswego can expect the storm in about an hour.
Conversion of Units	Meteorologists must convert Celsius to Fahrenheit when reading surface observations off a computer. Surface temperatures are in Celsius, and must be converted to Fahrenheit in the United States.
Geometry/ Angles	Angles are used to determine the type of storm that will hit. A line of clustered storms moves east, but an individual storm moves southwest to northeast. The angle of direction is measured to determine the type of storm.
Problem Solving	Droughts are measured by subtracting the actual rainfall to date from the average rainfall to date; the percent difference can show if a given area has a surplus or deficit.

Contributing Author: Abbey Wurz

Profession Chosen: Land Surveyor

Mathematics Concept or Content Area	Specific Example from Chosen Profession: **Land Surveyor**
Matching like items	When making a topographic map, surveyors need to identify points of the same elevation to draw the contours on the map. For example, points on a shoreline are at the same elevation.
Creating/ Continuing a Pattern/ Symmetry	When designing highways/roadways, surveyors calculate the centerline position on the road first and then they position the other lines symmetrical to the centerline.
Counting	When collecting field data, surveyors many times count the number of paces between objects as a way to roughly estimate the distance between things. Surveyors also count cars for traffic counts to determine traffic flow on certain roads or highways.
Using Numbers as Identification Codes	When collecting survey field data, every object either proposed or existing has a certain identification code number. This makes it easier for other workers to identify things such as buildings, fences, roads, or towers on maps. For example, surveyors might use the #100 to represent trees, or the #102 to represent buildings.
Orientation / Directionality/ Left & Right	Orientation relative to magnetic and true north is critical to surveyors. It is vital when creating maps that surveyors know precisely where they are. They establish orientation by using a compass or Global Positioning Satellite (GPS) equipment.
Using Numbers for Location	Numbers are used to number grid lines so that a point can be located on a map. For example, a street corner might be located at B-276.
Using Drawings to Solve a Problem	Surveyors prepare drawings that show existing conditions i.e., flooding problems. New drawings are created to show how to re-grade (move dirt to change ground slope) an area to help.
Using Charts, Tables, or Graphs	Construction bid documents require the use of charts, tables and graphs as a means to identify locations, quantities, and types of materials. This way, the client can see how these compare. For example, a client may view a chart that shows the amount of pavement needed in order to pave a new road.

Logic	Every survey project is unique and requires that a process be followed. For example, surveyors need to identify the existing conditions and then design the proposed improvements. For example, when building a new bridge, they must first identify why there is a need for a new bridge. It would be logical to build the new bridge with features that the old bridge was lacking.
Addition	Surveyors use addition when adding the distances of roadways in order to determine the total length of a highway. Lengths of highways are important when creating maps. For example, if one section of the highway is 100 feet, and 400 feet are added, the total highway would be 500 feet.
Subtraction	Subtraction is used when surveyors are making plans for smaller structures than existing structures. They must be able to calculate the differences in measurements between the structures. For example, how much shorter is the new bridge which is 100 feet high compared to the old bridge which was 175 feet tall? This requires surveyors to subtract the height of the small bridge from the large bridge to get a 75-foot difference.
Multiplication	Multiplication is used when surveyors have to convert certain measurements from feet to miles. For example: a roadway is 3 miles long and you need to know how many feet are in a mile. One mile is 5,280 feet. So, you would multiply 3 x 5,280.
Division	Division is used when surveyors have to convert certain measurements from yards to feet. If the length of a field is 300 feet, to determine the length in yards, you must divide 300 by three because one yard is equal to three feet.
Probability	Surveyors must take into consideration the probability of delays when completing a field project on time for clients. If a project occurs during spring, there is a high probability of delay because of rain or wet ground.
Estimation	Surveyors try to provide clients accurate estimates of cost and time for projects. If they estimate a project to take three weeks and it actually takes four weeks, extra money and time are spent.
Average (mean, median, mode)	Surveyors use averages to determine how long it will take to do a certain field project or computation. They then estimate the overall time a project will take in order to complete for a client. For example, they may tell a client it takes them on an average of three hours to determine property lines.
Percent/ Ratio/ Proportion/ Fractions	Changes in elevation are shown by percentages of grade. For example, a one- percent grade represents a one-foot change in elevation over a 100-foot horizontal distance.

Money / Decimals	Projects cost a certain amount of money. Surveyors give clients a bill that shows the cost of different professional services. The dollars and cents on the estimate/invoice are separated by a decimal point. A certain service might cost the client $1, 234.56.
Linear Distance Measurement	Surveyors measure linear distances for map-making using steel tapes. For example, a certain plot of land might measure 8,349 feet long.
Area Measurement	Surveyors calculate areas of parcels of land so people know how much land they are buying or selling.
Volume Measurement	Surveyors calculate the quantity of material to be moved for construction purposes. For example, they determine how many cubic yards of a material will be required to build a road and then they determine how to move the material. For example, a dump truck holds ten cubic yards of sand, pavement, or cement, etc...
Weight Measurement	When loading trailers, surveyors must make sure the weight is distributed evenly. They must load the heaviest equipment on the bottom of the truck and the lighter items on top of those heavier items.
Time Measurement	When using GPS equipment, the measurement of time is critical in order to establish the position of the satellites. Surveyors need to know the time they received the information from the satellites in order to calculate the latitude and longitude (position) on earth.
Conversion of Units	Surveyors convert between the English system and the metric system daily. Drawings can be in feet and inches or they may need to be converted to metric units or visa versus. For example, one foot equals 12 inches.
Geometry/ Angles	Geometry is used daily in computations of design projects. All projects: sewers, water lines, highways, etc... The field layout of that work requires the use of distances and angles based on a coordinate geometry system. For example, the highway may have a thirty-degree angle turn.

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